M.D. Thesis.

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DEVELOPMENTAL ERRORS.

In the pursuit of my profession as a general practitioner in Alloa, I recently came across two patients - both girls - in whom Anatomical errors in one of the upper limbs are of such interest (certainly rare) that I venture to hope their structural description will be accepted as a suitable theme for an M.D. Thesis.

I have not seen any reference to or a description of similar skeletal errors in books and the apparent rarity of these two cases calls for special notice.

Both are healthy girls, and I find no evidence in the family history of either case that points to a tendency towards mal-developments. In order to represent these errors as graphically as possible the patients kindly submitted to X-ray demonstration at our local Hospital and to a series of photographs being taken.

Case 1.

Lizzie Anderson, aged 19. Born at full-time: was of normal size, but the mother had a protracted and difficult labour owing to faulty attitude of left arm.

It probably will be the best plan to describe in a general way the various regions of the left upper limb, and make special notice of departures from the normal where they are found to exist. This limb viewed as a whole is diminutive and malformed: it also demonstrates from a topographical standpoint a striking conformity to the fore-limb in Birds. This comparison is more obvious when one examines the limb under X-rays. The comparative anatomy in each type is distinctly different, but at first glance this limb approaches the characteristics of the forelimb in Aves to an extent that I deem it reasonable to make mention of this peculiarity. The skeletal arrangement in the left upper limb in this case has certain definite characters of an unusual and rare kind.

The Region of the Shoulder- The muscular strata in relation to the shoulder girdle are well marked and give a distinct outline to the fossae in this region, but there is imperfect development of the pectorals in front and of muscles in connection with the scapula behind which cause a marked diminution of the Anterior and Posterior Axillary folds, and at the same time diminish the antero- posterior and vertical depth of the axilla.

The position of the head of the humerus is nearer the middle line as compared with the right side and at first sight simulates a subcoracoid dislocation, or appears as if it were due to a horizontal shortening of the clavi-pectoral region, but is really caused by a forward or anterior rotation of the scapula carrying with it the head of the humerus and not to any appreciable difference in the length of the clavicles. The clavicles are practically the same in length: the left clavicle looks shorter, but this apparent shortening is the result of an upward curve at its outer half.

The Scapulae:- Both bones are practically identical in point of development and measurement. The left scapula as regards its relation to the chest wall occupies a more anterior and lateral site as compared with the bone of the opposite side, and produces an evident projection of its vertebral border, allowing a greater degree of separation of these borders than is normally present when the arms are at rest and applied to the sides of the body. This wide interval between the vertebral borders is also in part due to poor muscular development with inability to move the left scapula backwards towards its neighbour.

The Humerus. The head of the humerus articulates with the glenoid cavity of the scapula and shows a decided inclination forwards and inwards; it is covered by the deltoid muscle. The head of this bone has a normal outline but is immediately succeeded by a cylindrical shaft of short diameter and as the lower end of the bone is approached it again tends to widen out. Skiagram No 1. on page 7 only demonstrates the shaft as it leaves the head of the bone but affords a good view of that part and the other bones of the limb. The hand is somewhat blurred in this picture, and had great difficulty in overcoming tremor sufficiently even

to get this result.

The muscles of the arm proper cannot be differentiated and are of feeble development.

Movements at the left shoulder-joint are as follows:-

Flexion:- The arm from a condition of rest beside the trunk is capable of being carried forwards through an arc of ¼ of a circle or thereabouts: further progress in this direction is prevented by a marked shortening of the pectorals and pronounced webbing of the skin of the axilla. Extension - very limited; adduction - forwards and inwards to a slight degree.

Abduction.- range of movement similar to flexion - about a ¼ of a circle. This movement is shown in Photo No 2. on page 5. the elbow required support while the photograph was being taken. Abduction beyond that limit checked by the webb of skin in the axilla.

Circumduction:- good. Rotation:-to a slight extent. The skiagram is not very clear at the hand, there being slight movement during exposure. The shoulder joint is to all appearance normal in configuration but movements of the arm in a lateral or anterior direction that exceed a right angle to the vertical axis of the trunk are not possible for reasons already stated.

The Elbow-joint:- It is in this region that definite structural change is observed. The bones that proceed to form this joint are lower end of humerus and upper end of radius.

There is total absence of the Ulna.

The lower end of the humerus is somewhat pointed and bulbous the most distal part assuming something of the character of an olecranon process. There are no humeral condylar processes, but the internal surface of the upper extremity of the radius has a projection

No 1.

which approaches the nature of an internal condyle. The articular facet at the lower end of the humerus has a lateral and internal position.

The upper end of the radius conforms to a certain extent to the normal outline, but the superior articular surface instead of capping this area is on its external aspect. The joint surfaces are thus brought into relation one to another in a lateral or side to side manner. This relationship is clearly seen in Skiagram No 2. on page 10 (unfortunately the patient moved her hand while this was under exposure). The external configuration of the left elbow joint is in marked contrast to that of the opposite side. Its greatest measurement is antero-posterior: a musculo-cutaneous web is present in relation to the anterior aspect of the joint having an attachment to the arm up to the junction of its middle and lower thirds and to the forearm for about $\frac{2}{3}$ of its length. The photo-graph on page 9 gives an outline of this structure. This web limits extension of the joint and at the same time maintains the joint in a degree of flexion as seen in the photograph on next page.

Movements at the elbow joint - the adaptation of the articular surfaces of the bones of this joint is such that a variety of joint of hinge - pattern obtains which permits of flexion and a small amount of extension.

The Forearm :- is composed of one bone - the radius. The upper extremity of the radius or what appears to be that bone has an outline which to some extent shows division into head, neck, and tuberosity. The

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shaft also has certain characteristics of that bone, but the lower end bears a striking likeness to the ulna. There is a projection at the distal extremity forming a fairly prominent styloid process.

The wrist-joint or Radio carpal articulation is formed by lower end of radius and one carpal bone; this arrangement is to be observed in Skiagram No 3. flexion at this point is possible to a remarkable degree: the movements of extension, adduction, abduction, and circumduction are present: but limited.

The Hand:- (left), is composed of an oval mass of soft tissue representing the thenar eminence: two metacarpals placed end to end: two claw-like digits - forming the thumb and index fingers.

The proximal metacarpal bone requires no special description but the distal is most peculiar and worthy of particular notice. Skiagram No 3. on next page shows the formation of the latter bone very well. It is Y - shaped: the base articulates with the distal end of 1st metacarpal. The oblique limbs of the Y articulate respectively with the thumb and index finger The thumb has two phalanges, and the index finger has three. The Skiagram (No 3) designed to show these details is not very clear owing to great difficulty in keeping the part at rest long enough for a proper exposure. On making the patient perform flexion and extension of thumb and index finger and opposing these digits, by looking through the fluorescent screen during these acts it was clearly observed that while the interphalangeal and metacarpo-phalangeal joints shared in these movements the Y metacarpal moved freely at the intermetacarpal joint as well. The hand in a state of repose is dorsi-flexed. The muscles on the anterior and posterior aspect of the forearm appear to be

Fig. 3.

Represented by a single tendon on each surface which seem to be entirely responsible for flexion and extension of wrist, thumb, and index finger. It also appears as if a tendinous slip were given off to the thumb: the flexor probably having a connection with sesamoid bone. There is great power in the index-finger, by means of which she can carry considerable weights: there is also marvellous dexterity in the use of both thumb and forefinger for sewing and knitting and in various ways she finds them of great service. Pronation of the hand is possible to a slight extent by abduction of the arm and rotation inwards of the head of humerus.

The Right Hand of this patient is of great interest there being seven digits present - the three inner apendages taking the place of the little finger. The thumb, index and middle fingers show normal characteristics, and the 4th finger although structurally normal is in the position of palmar flexion. These four fingers can be flexed, extended and opposed and their combined grasp is powerful. There is difficulty in describing the remaining three digits or appendages Skiagram No 4 on page 16 helps to indicate these three processes.

The most distal process occupies the place of the 5th finger and its three segments are of cartilaginous consistence. There are no cutaneous creases in relation to junction of its segments, the skin being thin, smooth and shining.

At the point there is an attempt at nail formation. There is no movement.

The middle process- the shortest of the three lies somewhat obliquely to the ulnar and palmar side of base of 4th metacarpal. There is no movement.

These two processes together might be considered evidence of an irregular development of the elements of the fifth finger - a short and stubby metacarpal, separated by an interval of one inch from imperfectly formed phalanges.

The proximal or 7th process. from a topographical and functional standpoint takes on the characters of a fifth finger. It bears three creases in the skin opposite its bony segments, and has a good nail formation on dorsal aspect of terminal phalanx. Flexion and extension are present, and it can move independently of the other digits.


No. 4

Case 2.

This subject has several skeletal curiosities in the right upper limb which are of great interest, and so far as I know, unique.

Gracie Drummond, age 11. She is strong and well: is most intelligent and has made good progress at school. Gracie is the youngest of 10 children all of whom are alive and well. No trace of tendency to developmental errors in the history of either parent. The right upper-limb, although greatly diminished in size, bears a remarkable resemblance superficially, to its neighbour. The external configuration of this limb shows in outline an attempt at formation of the antecubical fossa, and a slight fullness on its rostero-external aspect, midway between wrist and shoulder, simulates the prominence formed by the olecranon process leading one to suppose that the limb is composed of a short humerus, radius, and ulna, and a diminutive hand. This is not so however.

The skeletal arrangement is demonstrated in Skiagram No 4. Here also I found difficulty in keeping the limb sufficiently steady during X-ray exposure and

regret the results are not so good as I wished, but hope they are clear enough for descriptive purposes. The shoulder-joint is normal in all respects. The Scapula (right) is smaller in its vertical and transverse measurement by about one inch as compared with the left.

Muscular development good around the right shoulder girdle and there is a well-formed axillary space.

Movements at the shoulder-joint are free: abduction

and flexion possible to the extent of ¼ of circle.

A slight degree of lateral curvature exist.

The Humerus in its upper $\frac{1}{3}$ conforms to usual type, but a most marked departure from the normal takes place at the lower extremity. At this level the bone assumes the character of the lower end of the radius. The humerus in this patient thus plays a dual part.

Morphologically, its superior articular surface takes part in formation of shoulder-joint while its inferior articular surface enters into formation of wrist-joint.

THE ELBOW-JOINT IS ABSENT.

Opposite the lower $\frac{1}{3}$ of the combined humerus and radius an ⟨ shaped outgrowth of bone is observed which appears to be connected with the former structure. This small process might be considered a rudimentary ulna and takes part in the arrangement of wrist-joint. By the help of X-rays I watched the patient during the acts of pronation and supination of the hand and found these took place at the shoulder-joint, but that movement of a peculiar kind was also present at the junction of the two segments of the rudimentary ulna.

The wrist-joint presents a wonderfully normal outline and its movements are fairly well marked dorsi-flexion being the most limited.

The Hand is somewhat obliquely attached to the arm in an attitude of ulnar flexion and is poorly developed. The bones of the hand are typically arranged but on a small scale.

The thenar and hypothenar eminences are present.

The biceps appears to be continued onwards into the hand breaking up into tendinous slips for the fingers, and acts as flexor of wrist and fingers.

There is also power of opposing thumb to fingers.

The patient writes and feeds with the left hand, but can use the right for light-weight carrying. In movements requiring fine adjustment she employs the left hand to assist the right.


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